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NAVAL SHIP SYSTEMS COMMAND

SYMPOSIUM ON TECHNICAL DATA MANAGEMENT

SEPTEMBER 12-14, 1967

GSA AUDITORIUM AT 18TH AND F STREETS, N.W.,

WASHINGTON, D. C.

COMPUTER-AIDED SHIP SPECIFICATIONS

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Ship specifications are the primary technical documentation, referenced in the contract or purchase order, for the construction of all U. S. Navy ships. The ship specifications contain technical requirements and information relating to the construction of a particular ship or class of ships and describe the essential features, functions, and arrangements. Together with the contract drawings and contract guidance drawings, they define the work and responsibilities of the shipbuilding contractor in preparing working drawings and other documentation; and building and equipping the ship. Detailed requirements for equipment are contained in referenced documents, such as Military Specifications, and standard or type drawings.

The basis for each ship specification is the General Specifications for Ships of the U. S. Navy (Gen. Specs.). This specification contains requirements generally applicable to all ships and is updated every 3 months. I would like to quote from the preface of the first Gen. Spec. This preface is dated July 22, 1908, so you can see the Gen. Specs. have been around for quite a while.

In order to secure, as far as practicable, uniformity of practice, workmanship, and procedure in the construction of vessels of like type at the various building yards, and to avoid unnecessary repetition

You can see that the intent of the Chief Constructor in issuing the Jen. Specs. was to achieve standardization of shipbuilding practices and specifications. Detail (s.ip) specifications were first prepared

in an inference style, containing statements of exceptions and additions to the Gen. Specs. This was later changed to a ship specification format consisting of page and line changes to the Gen. Specs. In 1958 a new system of printing called Cardotype allowed us to go to a self-contained ship specification, and still retain the standardized text from the Gen. Spec. In this system each line of text is typed on a standard EAM card. These cards are processed through a high speed camera and the resulting negative used in a standard printing process. The Gen. Spec. deck of cards is used for ship specifications, with new cards added and Gen. Spec cards removed as necessary. This system greatly reduces the amount of typing and proofreading necessary and therefore reduces errors.

In one of our early self-contained specifications a typist was carrying a tray of cards to the camera to be processed. She dropped the tray and cards spilled all over the floor. Being new at the job and maybe not too sure of her job security, she hurriedly put the cards back in the tray and continued on her way. You can imagine what the resulting portion of the specifications, did to our confidence in the system.

I would like to go briefly into how we presently prepare ship specifications.

A single column copy of the Gen. Spec. is used as the basis. This specification is broken into sections and distributed to the cognizant NAVSEC branches. One engineer is responsible for each section, obtaining information from other branches as necessary to complete the section. The single

column Gen. Spec. is marked up by crossing out the material that is not applicable and adding material unique to that design, as well as other standard information applicable to that particular type of ship.

On a preassigned date the specification sections are assembled, checked for compatability, accuracy and completeness and sent to be duplicated by a direct photographic process. The resulting copies of the marked up specifications are packaged with the contract drawings and contract guidance drawings and circulated for comment, to approximately 60 different NAVSEC and NAVSHIPS branches and interested Navy activities.

Comments on each section are forwarded to the cognizant code, for the section, for adjudication and update of the master copy.

The specifications are then reassembled, and in conjuction with the drawings, reviewed, as a package, for correctness and compatability by the appropriate engineers at a technical reading session.

A final coordination review is held for the ship Project Manager and NAVSES Project Scordinators, followed by the approval signature of the design package and final typing and printing.

In 1964, serious consideration was given to use of the computer to prepare ship specifications. Prior to this time various methods of using automatic data processing equipment had been investigated and rejected. After considerable preliminary planning and investigation, a contract was awarded to the RCA Service Company on 2 September, 1966 to

develop the computer programs. These programs have been developed and are presently being revised to include preparation of a list of referenced documents. The programs use the IBM 7090 and the IBM 360/30 computers. Preparation of the master specification tape file has not yet been started, except for 5 trial sections used in developing and validating the programs.

Figures 1, 2, 3, and 4 are examples of the Gen. Spec. computer output. Note that the computer both left and right justifies each line. The print chain contains two upper case fonts and one lower case. At the time these pages were produced, the program still contained a few bugs. For instance column 1, line 65 in Figure 1, is not properly indented. However the program has now been debugged. Figure 1 shows mathematical equations in the text. Figure 2 is a single column printout used by the engineer in checking the specifications. The blank side of the page is used by the engineer for entering comments and changes. Figure 3 has a one-column table; and Figure 4 has a two-column table.

The master file will be prepared by adding to the Gen. Specs. that material presently included in ship pecifications, but not suitable for inclusion in the Gen. Spec. Material, such as specific design heads for structure, which can be included in the master file with blank spaces left for insertion of the appropriate figures, is an example.

Figure 5 shows how the master file will be broken into units of

information. You will note the varying lengths of the units. These can range from a single punction mark to several paragraphs or even several pages. Each unit is assigned a descriptor number in the left hand margin.

Note the editorial corrections. "Plane" is no longer used, so it has been changed to "drawinge". The word "explicitly" has been changed to correct the spelling. The computer chain used to print the output in the automated system does not have a square root sign.

Consequently, the words must be spelled out.

Concurrently with the preparation of the master file, a Yes/No questionnaire is prepared, Figure 6. Each unit of information is tied to a question by means of the descriptor number. A Yes answer to a question means that the corresponding unit or units of information will be printed in the ship specification. The questions will be combined to insure that each question needs to be answered only once, to withdraw the corresponding information, whereever it may be, throughout the specifications. One of the computer programs corts the questionnaire by functional area of NAVSEC branch cognizance. Figure 7 shows a sample questionnaire printout sorted for one branch. This sort capability enables us to assign each question to the engineer most qualified to answer it, regardless of the units location in the specification. For instance, the section on painting contains a statement similar to: "The rudder(s) shall be coated the same as the adjacent structure." The

has, but under the present system he must find out in order to properly :
write the sentence. With the new procedure, when the question on the number
of the rudders is answered for the rudder section of the ship specification,
it will automatically print the right word in the painting section.

Figure 8 illustrates a portion of the specification as it appears in the master file. The figure "110" in column 1 refers to the section, in this case section 9110-0 of the Gen. Spec. or any ship specification. The next column, from "120" to "230" indicates the unit number within that section. The third column indicates the line within the unit. The next column of figures, running from "3" to "68" are descriptor numbers, tieing the unit of text to a particular question. The "N" in the next column stands for non-Gen. Spec. material. By one command the program can delete this material and print a completely up to date Gen. Spec. The figures and letters in the next column are an external edit code controlling paragraphing, identation etc. Burried within the text is an internal edit code controlling type font, spacing etc.

The last six-digit control number is presently unused and provides sufficient flexibility for later improvements in the system. We must recognize that this computer program can also be used to print any material, where there—some logic between reading for printing or not printing the material. This extra control field might be required for some of these later programs, such as the preparation of Military Specifications.

Note the formula in figure 8 and as it appears in figure 9 with the internal edit codes processed.

Presently the Gen. Specs. are revised quarterly, with the computer program the master tape can be updated daily if necessary or at least immediately prior to each ship specification or Gen. Spec. printout, therefore the latest available information will always be included.

The system will also produce a listing of all references contained in the specifications. The listing will be produced by specification paragraph number for review. This review will insure that all references are current and correct. The final printout will be in alpha-numeric order by category, such as, all Military Specifications sorted in numeric order.

Now lets go through the preparation of a ship specification using the computer system.

Once the ship design is developed to the point where all the questions can be answered, the computer prints an up to date questionnaire sorted by cognizant code. These questionnaires are distributed to the proper engineers. The engineer answers each question Yes or No. Since each engineer involved will be checking only questions which are the center of his concern, for a design which he has just completed, 't is anticipated that the time required for completion of this questionnaire by individual engineers will be negligable.

The yes answers are keypunched and fed into the computer (IBM 7090). In effect, the computer reads a bit string indicating the applicability of descriptor numbers. It then enters an array of each descriptor and selects the applicable unit numbers. The computer then sorts the units into the correct order and prints a tape. This tape is the ship tape for that particular ship design. All future processing of this tape is on the IBM 360/30 computer.

The ship tape is processed to interpret the internal and external edit codes and format the pages including assigning page and line numbers. This original specification is produced in a single column format, using the universal character set chain. The ship tape contains no descriptor numbers or unit numbers and all future changes to this tape are made by use of the page and line numbers.

This specification is broken into sections and distributed to the appropriate engineers for review and adding of any needed additional information. The time required for this step depends on how effective we are in preparing the master tape and how well we succeed in keeping

it current. Corrections are coded, keypunched, and fed into the computer to produce the comment copy, again a single column copy. The comment copy computer output is reproduced by a standard printing process to provide the copies required for circulation for comments. From this point to signature, the process is the same as under the present system. After signature the corrections are coded, keypunched and fed into the computer to produce the final double column ship specification.

Advantages

A large portion of the Ship Systems Engineering and Design Department manpower is used to produce ship specifications. This computer-aided ship specification system will greatly reduce this engineering manpower requirement.

By using a Yes/No questionnaire we can assign preparation responsibility, for each unit of information, to the engineer most knowledgable of the area, in lieu of the present method of assigning preparation responsibility by specification sections. This also reduces the chance for conflict between sections of the specifications.

By putting all generally used non-Gen. Spec. material in the computer, we standardize the wording and prevent each engineer from using slightly different wording and possibily getting different interpretations at the user end. It is not uncommon to receive a telephone call from a shipbuilder asking "Why did you change 'such and such' requirement in the specification?" and to discover that, in fact, there was no intention to change the specification, but that different wording was used by a different engineer.

One of the major sources of error or conflict in the ship specifications is last minute changes in the design. Presently we catch the obvious places, but someone doesn't get the word and one or more affected requirements remain unchanged. With our questions aire and descriptors we can rapidly locate all the text that requires change.

Problems and Future Improvements

The biggest problem is to get the master tape accurate and complete, and to insure that it is maintained current at all times. The manpower and effort required, must be expended to insure this initial accuracy.

Also, changes must be made with the least possible effort on the part of the engineer, while still maintaining strict control of all changes.

Computer output has many limitations anen compared with standard printing, such as legability, and range of type fonts and characters available. We are investigating the use of the Linotron, presently being installed at the Government Printing Office. This equipment takes standard computer tape and processes it through a standard printing process. Our early checks show that only minor changes will be required in our present computer system to use the Linotron for our output device.

We may want in the future to reduce the quantity of questions to be answered for each ship specification. This would involve having several questionnaire tapes, one for surface ships one for submarines, one for commercial type ships, etc., or by adding another program to the system we may be able to do this by answering certain key questions prior to the printout of the questionnaire.

Presently the system uses a card input, several possibly more efficient methods are presently available, or are under development. These are being followed with interest and will be considered for future inclusion in the system.

In summary, we have now developed a system which permits us to do an excellent job of preserving experience, standardizing ship specifications, assuring completeness, coping with dynamic technology, and assuring that the ship specifications are tailored to the particular project. Additionally, the system produces an output which is easily used, and which can be produced at a reduced cost, both in preparation and in use.

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the neutral axis to the extreme tibers. Dack live loads.—As specified. Dead loads.—Weight of structure and building trooms, and the atmosphere, shall be provided for missile majazines, assembly rooms, and check-out areas.) Ship motion.—Inertia forces and gravity components resulting from mution of the ship in a seaway. Sea forces.—Static-equivalent reads, representing the effects of wave action on the shell and weather decks. Tank pressures.— Hydrostatic heads on tank boundaries, including the there is no danger of failure from		ue assumed to be j of the larger of the values calculated for the extreme	boster, in	
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muction of the ship in a seaway. loads, stresses in structural members, sea forces. Static-equivalent needs, representing the effects of wave action on the shell and weather decks. Tank pressures. Hydrostatic heads on tank boundaries, including the there is no danger of failure from	65	equipment. Ship motion. Inertia forces and	magazines, assembly rooms, and check-out areas.)	135
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KO 4184		action on the shell and weather decks. Tank pressures. Hydrostatic heads	allowable limits Tensile and bending stresses Where	140

K5 4294

1 JULY 1765

SECTION 9110-0 GENERAL REQUIREMENTS FOR MULL STRUCTURE Seperandes section S11-0, Dated 1 January 1963

9110-O-a. Design

General.—The contractor shall assure that the scantlings depicted on the structural drawings are adequate for the intended purpose. Compliance with such drawings or subsequent approval of changes made by the Contractor does not relieve the Contractor from making the necessary structural calculations, preparing an alequate structural terms, and building an alequate only structure in accordance with the design cliteria given herein. Ship structure shall be designed so that when subjected to specified loads, the allowable stresses or deflections will not occur be exceeded, and failure will not occur from a condition of elastic instability. DESIGN Data Sheets DDS9110-1, DDS9110-2, DDS9110-3, and DDS9110-4 illustrate acceptable methods of ship structural design.

design.

Structure for which loads are not explicitly specified shall be rugged enough to withstand the stresses which can reasonably is expected in service. Additional local stiffening, if found necessary, shall be installed to prevent excessive vibration, panting, or springing of missing.

excessive vibrution, panting, or springing of plating.

Design loads -Ship structure shall be designed to withstand the following loads.

Ship bending. The bending loads on the hull as a whole from gravity and inertia forces, with the ship statically balanced in hogging and saguing conditions. Waves shall be assumed to be trochoidal, of length L and height 1:1 times the square root of L, where L is the length of the ship between perpendiculars, in feet. For the design of members which constitute the longitudinal strength girder, 50 the longitudinal strength girder, ship-bending stresses (tension and compression) at the neutral axis shall compression) at the neutral axis shall be assumed to be \$\frac{1}{2}\$ of the larger of the values calculated for the extreme fibers. (See DD99290-2). Stresses shall be assumed to increase uniformly from the neutral axis to the extreme fibers.

Dack live loads. As specified.

Deed loads. - Weights of structure and 65 equi, ment. Ship motion. - Inertia forces

ship motion.- Inertia forces and gravity components resulting from motion of the ship in a seaway.

Sea forces.- Static-equivalent heads, representing the effects of wave action on the shell and weather decks.

Tank preserves.- Hydrostatic heads on tank boundaries, including the K6 area

K5 area

70

FIJURE 2

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095

1 30

1 00

GENERAL SPECIFICATIONS FOR SHIPS

05	DEPTH OF WEB	MAXIMUM DIAMETER OF HOLE	SPACING CENTER TO CENTER
••	Inches	Inches	Inches
	6	2	6
	7	31	2)
	•	3	7
10	•	3 j	73
	10	•	•
	11	•	
	12	4;	9
	13	5	10
15	14 and 15	5 by 9(1)	(3)
	16 to 18 incl.	6 by 9(1)	(3)
	over 18	(2)	(3)

(1) Long dimensions shall be parallel

20 to the girder.
(2) Depth of hole shall not exceed 40 percent of the depth of web, and the length of hole shall not exceed twice its own depth.

(3) Holes shall be spaced so that the distances between edges of adjacent holes will not be less than one and one-fourth times the length of the holes.

For submarines, the For submarines, the For submarines, lightening holes in transverse floors shall be increased in size in locations where quick flooding demands fore and aft flow of water through the frame. Where this is done, the weight of the floors shall be increased to maintain the strength of the floors, and flat bar reinforcement shall be fitted around the edges of the holes.

Corner radii of rectangular openings in pressure hull plating shall be as

Corner radii of rectangular openings in pressure hull plating shall be as specified in 9110-1.

Drain holes.— In nontight structure, drain holes shall be cut and water courses provided to prevent the accumulation and retention of liquids and to permit their free flow to drains, scuppers, sumps, and suction pipes. In montight portions of bottom longitudinals and the vertical keel drain holes shall be located to insure bottom longitudinals and the vertical keel, drain holes shall be located to insure drainage of each bay formed by longitudinals and transverse frames. In compartments fitted with suction piping, the total area of drain holes through any frame or longitudinal shall be at least twice the area of the largest suction pipe.

The number and size of drain holes be reduced by including the area of cutouts for shell seams and butts where

they are available for drainage.
In large structural castings and weldments, drain holes shall be provided to insure complete drainage.

to insure complete drainage.
Air holes.- In nontight structure of tanks and bottom compartments that are fitted with filling and drainage arrangements, air holes shall be provided to prevent the formation of air or gas pockets and to provide clear passage to air escape pipes.

9110-0-c. Workmanchip

Pairness. Por surface ships Departures from the molded form shall be held within the following limits Plus or minus } inch from the vertical longitudinal center plane.
Plus or minus 1 inch in 100 feet of 980

Plus or minus ; inch vertically from the base line.

Por submarines

Por submarines
Circularity measurements of pressure
hull plating shall be taken throughout
those portions of the pressure hull and
pressure hull appendages which are intended to be circular.

All circularity measurements shell be taken on the pressure hull placing. If measurements are taken on the surface of measurements are taken on the surface or the plating to which frames are attached, the measurements shall be taken as close to the frames as is practicable. If measurements are taken on the surface of the plating opposite that to which frames are attached, the measurements shall be taken on the frame line.

Circularity measurements shall be taken 100 the following locations

shall be taken on or One set adjacent to each deep frame. One set shall be taken on or adjacent to the first unsupported frame both forward and aft of each full diameter internal bulkhead. (The Lame adjacent to a bulkhead can be considered to be supported if the vertical and horizontal bulkhead stiffners are bracketed to the frame.) bulkhead

One set shall be taken on or adjacent to each frame both forward and aft of each full circumferential butt.

One set shall be taken on or adjacent to at least every third frame. adjacent to at least every third frame. Circularity measurements shall be taken so that a complete trace of the actual contour of the hull may be obtained at each station even thoug: tanks forming a part of the ship's structure are located inside the pressure hull.

A circle whose area equals the area enclosed by the trace of the actual contour shall be drawn. This circle shall be considered to be the mean circle.

considered to be the mean circle.

The mean circle may be positioned over e actual contour so that deviations tween the mean circle and the contour. bet veen are minimized.

following requirements

The following requirements for circularity shall be met

The trace of the actual contour shall not deviate from the mean circle by more than ; the thickness of the pressure hull plating or ; inch, whichever is less.

The radius of the mean circle shall not depart from the design radius by more than ; the thickness of the pressure hull plating or ; inch, whichever is less.

more than a tree that pressure hull plating or a inch, whichever is lass.

Heasurements shell be taken after all major welding in the vicinity has been completed. The installation of closure plates shall be considered major welding R6 area

E5 area

TABLE 1

thee	Spec. No.	Alley	Condition Grade or Class	Renarks
Castings	QQ-A-601			
		356	3M	Note 1
Castings	QQ-A-601			
Ť		195	414	Note 2
Castings	QQ-A-601	214	5M	Note 3
Plates	QQ-A-250/7	5086	H32	Note 4
Plates	20-A-250/9	5456	H321	Note-5
Plates	QQ-A-250/10	5454	H34	Note 6
Plates	QQ-A-250/11	6061	T6	Note 7
Shapes				
Extruded or rolled	QQ-A-200/5	5086	H111	Note 4
Extruded	00-A-200/7	5456	H111	Note 5
Extruded or rolled	00-A-200X/6	5454	H111	NOTE 6
ROLLED OR DRAWN	20-A-225/0	6061	T6	Note ?
Extruded	00-A-200/8 or			
	ASTM B221	6061	T6	Note ?
Tubing				
Drawn or extruded	WW-T-700/5	5086	H32	Note 4
• •Welded	QQ-A-250/7	5086	H32	Note 4
All sizes	WW-T-700/6	6061	T6	Note 7

Note 1 - For use with complex castings where castability, pressure tightness, strength, and resistance to corrosion are required. Will respond to heat treatment to improve strength. For applications requiring high casting quality and excellent fluidity.

Note 2 - High tensile, with less corrosion resistance than class 1, 3, 5, 7, and 8. Heat treatment is required. For uses such as ammunition stowages, frames and sills for joiner doors, and ladder treads.

Note 3 - For use wherever good tensile strength and relatively high resistance to corrosion is required. Heat treatment is not required. For applications similar to class 4 but requiring resistance to corrosion at a sacrifice of tensile properties.

Note 8 - Shall be used for applications where higher strength is required and where higher cost is warranted.

Note 5 - Shall be used for applications where high strength is required and where
thigher cost is warranted.

Note 6 - For structure subject to elevated temperatures over 150 degrees F., such
as upper portion of smokestacks.

Note 7 - This alloy shall be used for nonwelded structure only,
eDrawn preferred - Consideration must be given to wider dimensional tolerances when
estruded tubing is used.

estuding manufactured from plate and having a longitudinal welded seam may be used for
tubing sizes that are not available in drawn tubing.

		FOR OFFICIAL USE ONLY
0	5	GENERAL SPECIFICATIONS FOR SHIPS OF THE UNITED STATES NAVY DEPARTMENT OF THE NAVY
i		NAVAL SHIP ENGINEERING CENTER
0		SECTION 9110-0
0	10	GENERAL REQUIREMENTS FOR HULL STRUCTURE
1		Supersades section 9110-0, deted 1 Jenuary 1963
		9110-0-a. Design General.—The Contractor shall assure that the
\mathbf{O}	15	scantlings depicted on the structural program of the structural progra
		adequate for the intended purpose. Compliance with
_		such along or subsequent uppreval of thurses made
2		by the contractor does not relieve the Contractor
	20	from making the necessary structural calculations,
		preparing an adequate structural design, and build-
		ing an adequate ship structure in accordance with
		the design criteria given herein. Ship structure
		shall be designed so that when subjected to speci-
	25	fied loads, the allowable stresses or deflections will not be exceeded, and failure will not occur
		from a condition of elastic instability. Design
		* Data Sheets CDS9110-1, DDS9110-2, and DDS9110-4*
		illustrate acceptable methods of ship structural de-
	30	agn.
		Structure for which loads are no emicing explicitly
		sheritter sign or indian mode, management
		stresses which can reasonably be expected in
		service. Additional local stiffening, if found
	35	necessary, shall be installed to prevent excessive
		vibration, panting, or springing of plating. Design leads. Ship structure shall be designed
7		to withstand the following loads:
J		Ship-bending.—The bending loads on the
2.	40	hull as a whole from gravity and inertia forces,
~		with the ship statically balanced in hogging and
		sagging conditions. Waves shall be assumed
		to be trochoidal, of length L and height 1.1
	4-	to be trocholded, or langth L and height 1.1 times the square root of L.
3	45	perpendiculars, in feet of For the design of members which constitute the longitudinal
•		strength guider, ship-bending stresses (tension
		and compression) at the neutral axis shall be
		gasumed to be one-half of the larger of the
	50	values calculated for the extreme fibers. (See
		DDS9290-2). Stresses shall be assumed to
		increase uniformly from the neutral axis to the
4		extreme fibers.
7		Deck live feedsAs specified.
	55	Poed loads Weights of structure and
		equipment. /

OUESTION	APPLIES TO GEN. SPEC. OMLY	IS THIS A SURFACE SHIP	IS THIS A LOWGITUDIMALLY FRAMED SURFACE SHIP	IS THIS A SURFACE SHIP WITH COMPARTMENT BOUNDARIES DESIGNED TO A HEAD TO THE DAMAGE CONTROL DECK	IS THIS A SURFACE SHIP WITH GUMS	IS THIS A SURFACE SHIP WITH A MISSILE LAUNCHER	IS THIS A SURFACE SHIP WITH ONE MISSILE MAGAZINE	IS THIS A SURFACE SMIP WITH MORE THAN ONE MISSILE MAGAZINE	IS THIS A SUMPACE SHIP WITH ONE MISSILE ASSEMBLY MOOM	IS THIS A SURFACE SHIP WITH MORE THAN ONE MISSILE ASSEMBLY ROOM	IS THIS A SURFACE SHIP WITH ONE MISSILE CHECK-OUT AREA	IS THIS A SUPFACE SHIP WITH MORE THAN ONE MISSILE CHECK-DUT AREA	IS THIS A SURFACE SHIP DESIGNED FOR NUCLEAR BLAST	IS THIS A SURFACE SHIP USING MEDIUM STEEL STRUCTURALLY	IS THIS A SURFACE SHIP USING MIGH TENSILE STEEL STRUCTURALLY	IS THIS A SURFACE SHIP USING HY-80 STEEL STRUCTURALLY	IS THIS A SURFACE SHIP USING ALUMINUM ALLOY STRUCTURALLY
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AUTOMATED QUESTIONNAIRE FORM FOR THE GENERAL SHIP SPECIFICATION SYSTEM

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_	120		9 -0	NEUTRAL AXIS TO THE	00000
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	components resulting from motion of the ship in a	Bes. Static equivalent heads,	representing the effects of wave action on the shell and weather	figet an absent rivership in a second	boundaries, including the effects of filling to	ONE.	SECURITY DATA CONTRACT STOCK ACCES AND CONTRACT STOCK STOCK ACCES	ing design londs, where applicable, shall be	combined to produce the most adverse conditions of		except that where combined with primary hull bending	Strenges, medonaty Strenges in talks state De Geter	Structure shall also be designed for the following	sidered Individually:	Franchise Hydrografic near to the damage control	partaents	Gem black. A static equivalent bead, An Reet of	1		1 (1) 1)		Where:	us to the boint in question;		space and a between the radius vector and he has our barrel.	Missile blast - Static equivalent head in feet	to the property of the propert	V/(1 UTS/C770*0+) UTS/C770*0+)	I is the total thrust of the missile, in poinds;	of incluence (ranging from 20 to 90		constitute the minister core in the blast core is			Accidental missile ignition A static-equivalent	_		in rate of the missis broaden in	bounds the percond;	A is the total area, in square feet, of blowout		PICTURE O	
Dand Londer-	components resul	es forces.	the effects of wave	decks.	boundaries, Incl	owerflow.	installed equips	The foregoing de	compined to produce	atress.	except that where o	Service season as a CONDEST A SEASON AS A	Structure shall als	loadings, considere	deck, on the bou	watertight compartments.	Com MastA	Tenha Tenha Ban		CT 503 + 13055	(R/b)	where:	the nearest dum to	D is the diameter o	A is the space angl	Missile blast.	or sea water, equal to	where:	T is the total thru	Y is the angle of it	A is the area of th	inches, bounded by the blast	having a three-dear	passing through the	Accidental missi	head, in feet of se	*. SR/A	Where:	pomya per second:	A is the total area	open mys. (seen open		
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